months ago regarding MSS sharing with Metsats and Metaids. This paper (WP7C/23) was a U.S. contribution to the international meeting of WP7C in November 1994. Moreover, NOAA itself submitted input papers to the WP7C meeting in Geneva that presented information on Metaids required for coordination and sharing studies (Doc. 7C/18).

Second, NOAA states that "Both the Commission's Industry Advisory Committee (IAC) and ITU-R's SG8D have produced output documents which are pessimistic about the possibility of successful sharing between radiosondes and the MSS" (NOAA, at 6). However, the pessimistic views of the IAC and the CPM-95 regarding MSS/Metaid sharing dealt with using the 400 MHz band as a downlink, not the 1675-1700 MHz band as an MSS uplink. Because of the differences in direction and technology employed in the two bands, the conclusion about the 400 MHZ does not apply to 1675-1700 MHz. In regard to MSS/Metaid sharing at 1675-1700 MHz, the IAC (as well as the CPM in its Final Report) only said further study is needed. And, although the report of the WP8D Chairman did indeed express a pessimistic view of the feasibility of MSS/Metaid sharing, this view was not supported by any input or output document of WP8D. Similarly, there was no discussion in any forum of the WP8D meeting that would support such a view. The output documents of WP7C, WP8D and the CPM only reflect the fact that further study is needed.[21]

CORF reports that radiosondes are used for research purposes "and are often employed as a source of ground-truth for passive remote senors". These studies are "typically done on campaigns of several weeks duration".

Clearly, scientific work of this kind is important. But the constraints of "ground-truth" validation and "several weeks" of operations are quite different and far less stringent for spectrum sharing than those of NOAA. Moreover, the cost constraints of the 100,000 soundings per year for NOAA are quite different than those for research purposes. Since we believe there is a high likelihood that sharing techniques can be developed between NOAA and MSS

[21]AMSC suggested that as a spectrum conservation inducement to the meteorological aids community to reduce the outlandish frequency drift of radiosondes, that the Metaid allocation be reduced to 1668.4-1685 MHz. This still allows too much drift and we suggest the Metaid band should be 1668.4-1675 MHz, perhaps after some lead time such as five (5) years.

interests, it appears virtually certain that sharing techniques be worked out with CORF members' use of radiosondes.

In these days of spectrum shortages it is important to note Metaids are allocated almost 32 MHz of spectrum to provide a service that is transmitting tens of bytes of information per second. The Commission and the nation can no longer permit such inefficient use of valuable spectrum.

The Commission should seek to have WRC '95 delete RR 735A except for the provision in RR 735A that states that future use of the 1675-1710 MHz band is subject to Resolution 46. If additional sharing studies are necessary to protect Metaids, this can be achieved in subsequent domestic rulemaking proceedings.

D. 2 GHz Allocation.

All parties except AMST support new MSS allocations in the 2 GHz band to replace the global MSS frequencies that were lost to PCS in the U.S. At the time the Commission adopted its PCS band plan last year, it indicated that it would seek new global MSS spectrum at WRC '95 to replace that which it had carved out of the

MSS bands for PCS*[22]. It is extremely important for the future growth of MSS that more global MSS spectrum be allocated. Iridium believes that the 2 GHz band is the first place to begin in looking for new spectrum.

E. 2 GHz Bands: Advancing the 2005 Date.

All MSS operators and AMST uniformly opposed the idea of advancing the 2005 date-of-entry for the 2 GHz bands. Only Comsat Mobile supports moving the 2005 date forward in time. Iridium agrees with the majority view on this issue. The date should not be advanced until a transition plan is in place for the current users of the band. As the Final Report of the CPM stated, "Administrations concerned with the effect of the MSS on their FS systems considered that the review of the date 2005 is to be considered by the WRC'95 on the basis of the difficulties they encounter in removing FS systems whose replacement may result in relatively sever economic impact.[23] Clearly, this is not a domestic problem.

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[22]See Memorandum Opinion and Order in the Matter of Amendment of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, 9 FCC Red 4055 (1994).

[23]CPM Final Report, at Section 4.5 (p.37)

CONCLUSION

WRC '95 presents an opportunity both to improve the current MSS allocations and associated regulatory procedures in order to facilitate their use by MSS operators, and to create new MSS allocations to meet anticipated demand in the near future. It also affords an opportunity to refine the agenda for WRC '97. In furtherance of these objectives, Iridium urges that the foregoing proposals be incorporated into the U.S. objectives for WRC '95 and WRC '97.

Respectfully submitted,
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Review of CPM 95 Sharing Studies between 20/20 GHZ/FSS Networks and NGSO Feeder Links for MSS Operating in the 1 - 3 GHZ Spectrum

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Review of CPM95 Sharing Studies between 20/30 GHz GSO/FSS networks and NGSO Feeder Links for MSS Operating in the 1-3 GHz Spectrum

Introduction

In 1993 and 1994, ITU Task Groups and Working Parties addressed various aspects of technical and operational constraints for the feeder links of NGSO /MSS networks which have their service links in the 1-3 GHz spectrum and are co-primary with GSO/FSS. From these studies, recommendations for operational and regulatory changes to the Radio Regulations were made. These studies and recommendations were summarized in a consolidated report, CPM95/6 prepared in Dec 94. Because of the compressed schedule between WARCs and the complexity of these technical studies, some of these studies were considered preliminary and in some areas further work was indicated. However, these Task Groups are not meeting in 1995 and it is up to the CPM and finally the WARC itself to decide whether the studies are sufficient to make recommendations for changes in the Radio Regulations. The CPM concluded its work on April 5 (CPM95/118) and no consequential changes were made to the draft technical and operational studies conducted earlier or to a list of suggested options of changes to current regulatory /procedural aspects of the Radio Regulations. However, some additional sharing studies were provided directly to the CPM and are considered in this review.

The following sections examine various elements of these studies with regard to their technical completeness and conclusions. Of special concern is the applicability of these studies to the Iridium® system currently developing a world wide NGSO/MSS feeder link system in the 20/30 GHz band.

Network Characteristics

The general characteristic of networks for both Non-GSO/MSS feeder links and GSO/FSS used in the various 20/30 GHz sharing studies can be categorized as below:

GSO/FSS

- a-VSATs with earth terminal beam widths 1 degree or greater and narrow band data
- b- Wide band traffic links with earth terminal beam widths of about 0.1 degree

Non-GSO/MSS Feeder Links

- a - All earth terminals have beam widths about 0.1 degree and track steerable satellite spots.
- b- Some satellites are regenerative transponders carrying moderate bandwidth data
- c- Some satellites were transparent and carrying narrow band voice channels
- d-Some satellites are in low circular earth orbit (LEOs) and others in high (ICO)

In Line Interference Geometry's

The Non-GSO satellites are in motion relative to GSO satellites and the Non-GSO earth terminals are continually tracking their satellites. Therefore, the peak interference between the two types of satellite systems are transitory and semi random in occurrence. These interference peaks occur when one of the geometry's described in Figures 1-4 should happen along with co-frequency operation. The distance between the respective earth terminals is frequently used as a parameter. All Non-GSO systems have circular orbits but the height ranges from 800 km to 10,000 km. Most studies considered a full constellation of Non-GSO satellites with one earth terminal and one co-frequency GSO with its single earth terminal.

Service Objectives /Service Quality/Interference Budgets

Historically the FSS had developed a set of service objectives and service quality that paralleled the same criteria as trunked wire line or point to point microwave. Long term intra-service interference budgets were developed between co-frequency GSO networks that would allow efficient utilization of the arc and allow each network to meet its service objectives. These budgets allowed the arc to be fully utilized with transparent transponders carrying trunking traffic in the 6/4 and 14/12 GHz bands.

In 1994 TG 4/5 undertook studies of interference budgets for GSO/FSS links sharing the same frequencies as NGSO/MSS feeder links. It was recognized that interference events between these two types of networks were of a short term nature and new interference budgets would have to be established. TG4-5/33 was a contribution from INTELSAT that assumed that all future GSO systems would mostly be carrying digital traffic and the performance requirements of Recommendation ITU-R(Doc. 4/277) were used as objectives. Allowable short term budgets for interference from NGSO feeder links were derived based on link margins and propagation statistics.

A subsequent contribution from INTELSAT (TG4-5/66) expanded the analysis to include GSOs operating at 20/30 GHz. This contribution recognized the difficulty of meeting the service objectives due to practicality of achieving sufficient link margins at these frequencies where rain attenuation is severe. Never the less, by assuming the GSO would use **site diversity** for its earth stations and be only located in moderately rainy **climatic zones (E)**, a set of short term criteria for interference from NGSO was derived based on a allocation where degradation from NGSO was set at 10% of the outage time estimated due to atmospherics. It was noted that the GSO could not meet these service objectives in more severe climates so the budgets for interference Non-GSOs could be increased in those regions.

These interference allowances for interference from NGSO/MSS into GSO/FSS are summarized in Section 3.1.2 of Part C Table 8A CPM95/118.

In 1994, TG 8/3 was solicited for short term interference criteria/service objectives for the various proposed NGSO/MSS systems and could only provide the one criteria summarized in Section 3.1.2 Table 8B which is applicable to the 4-8 GHz bands and is somewhat more stringent than the criteria for interference into GSOs. In the TG8/3 recommendation, an outage is defined for interference greater than 0.7N_t and cannot occur for a cumulative annual percentage greater than .001% of a year.

Iridium (LEO A) has been in development for several years now and has been endeavoring to develop a design that would maximize its service objectives everywhere in the world. As previously noted, atmospherics can be a significant limitation in many places in the world. In addition, LEO A feeder link stations must operate to elevation angles as low as 5 degrees in the lower latitudes. Not only are atmospherics a bigger problem at these low elevation angles but the potential for interference into up links from FS is increased as well.

LEO A carries trunking type digital traffic consisting of telephony from its service links either direct from the service links of a single satellite or relayed through its intersattelite links, administrative data across the network, and telemetry data from the satellites. The service quality requirement for these links is a **BER of 10-7** or better. This system uses adaptive power control for both range compensation and rain attenuation. Satellite prime power and other technical limits require that the nominal margin for unexpected short term interference events be limited to about 3 dB. Therefore, an interference to noise ratio (Io/No) of about **-1 dB** is threshold above which the system quality objectives would not be met

DIAGRAMS OF INTERFERENCE CONDITIONS

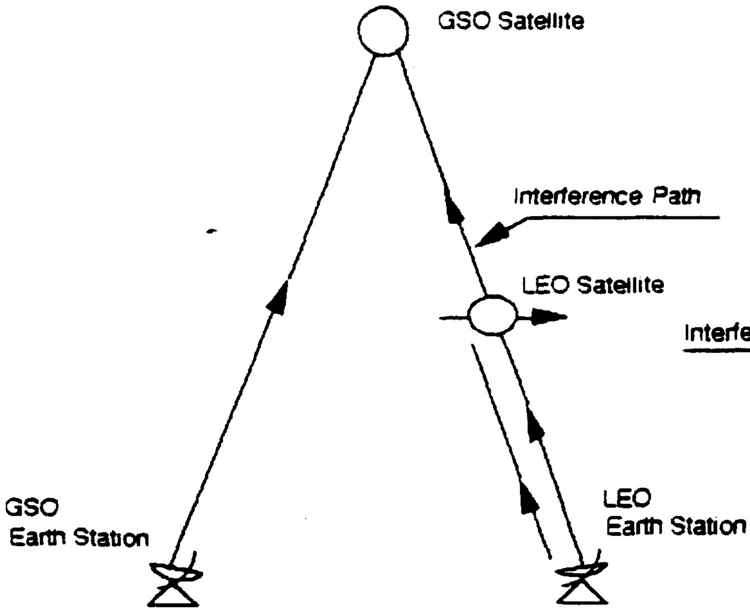

Figure 1
Uplink LEO Interference into GSO

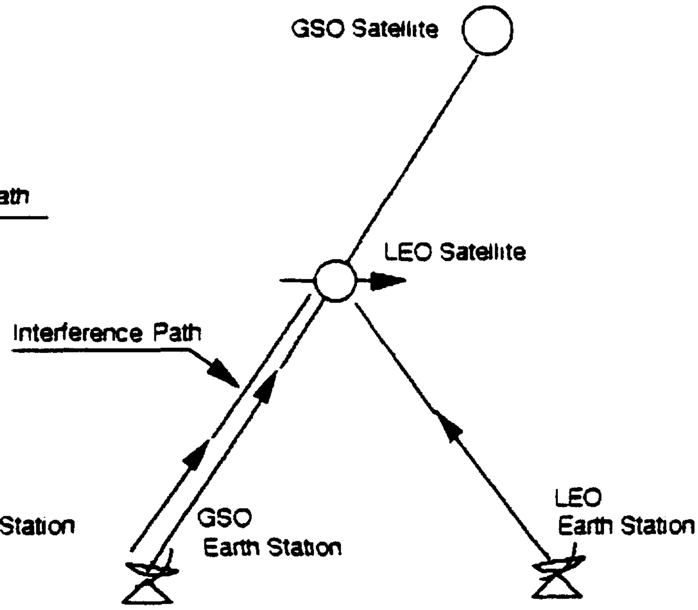

Figure 2
Uplink GSO Interference into LEO

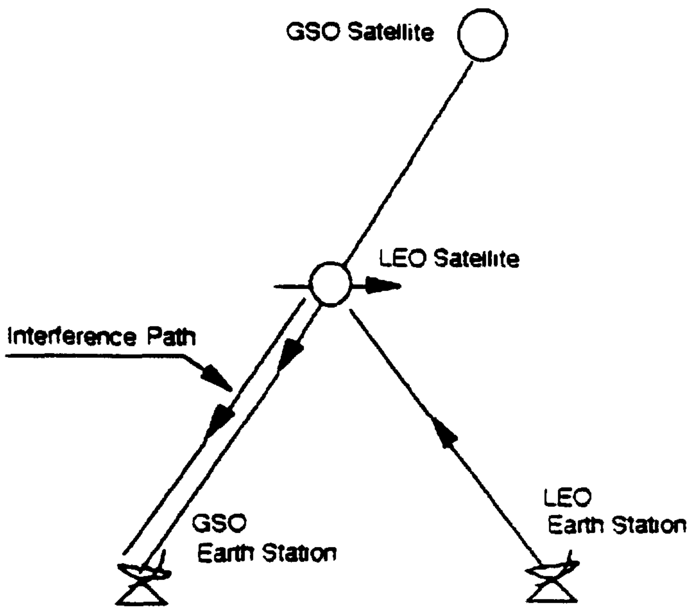

Figure 3
Downlink LEO Interference into GSO

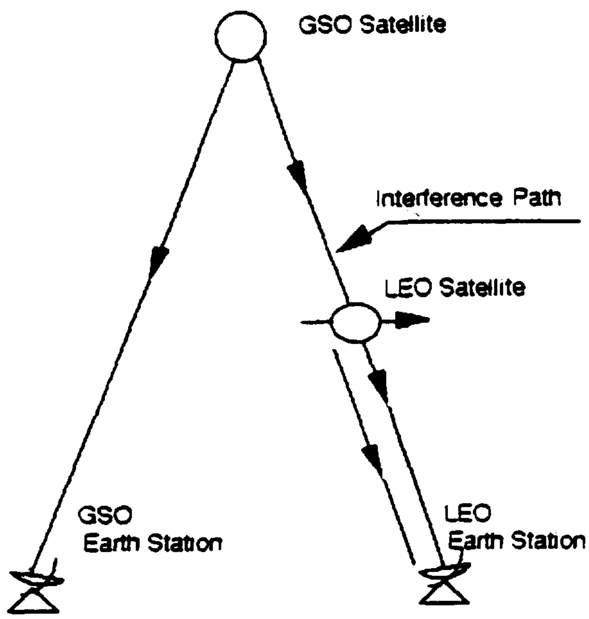

Figure 4
Downlink GSO Interference into LEO

A budget for the allowable time allocated for external short term outages as a function of earth station site design and climatic location is still being developed along with detailed service objectives and technical means to achieve those objectives. Because of the atmospheric statistics in the 20/30 GHz band, using a criteria based on annual outage percentages as proposed for GSO networks may not be satisfactory to a user in certain climatic zones. Monthly maximum percentages may in fact be more appropriate.

However, Motorola proposes to examine the feasibility of sharing with GSO/FSS systems with the following straw man criteria for short term interference from the GSO networks on the assumption an annual availability of 99.0 % can be achieved for an average gateway earth station:

I = .79Nt for .01% of time on an annual basis cumulative per up and down link

It should be noted that LEO A is a processing satellite with sterrable spot beams and outages could independently happen between the up and down links. Similarly, transparent GSOs with spot beams could also encounter independent outages.

Motorola does not suggest this short term Non-GSO criteria should be applied to other NGSO/MSS feeder links at 20/30 GHz band. To date, all other proposed MSS systems employ transparent transponders carrying mostly extensions of service link narrow band voice and data over their feeder links. The availability of hand held earth terminals in the service links is not high relative to what can be achieved on the feeder links with large tracking antennas so probably the driver on the overall availability is the service links. Short term interference budgets for these networks should be set accordingly

Finally, any new system/service will have its service objectives ultimately determined by the market place. Services provided by such systems as Iridium will be tested in the market place by customers who will set the final cost/service objectives for a successful new system.

Interference from NGSO networks into GSO networks

Large GSO Earth Terminals

Intelsat (TG4-5/106-E) developed a computer simulation for studying the potential for interference from NGSO MSS feeder links into a hypothetical KaBand GSO network. The straw man GSO used in the simulation had its link margins set such that service objectives of ITU-R S.1062 could be met in a moderate climate zone using site diversity. The NGSO satellite characteristics were those of LEO A and the GSO used spot beams and evaluated links to earth terminals ranging in size form 1.2 to 5.5 meters (<< 1.0°). (LEO A has 3.0 meter antennas)

It was concluded that the most severe event occurred in the down link to the GSO terminals. This is not surprising since, on the average, there is 30 dB additional range loss on the up link to the GSO arc. On the down link the outage time was greatest into the 1.2 meter station with the widest beam width. These terminals suffers outages that are 25 times longer than the allowable budget. Intelsat then concluded that sharing at KaBand is only feasible if the NGSO "ceases transmissions or by carefully choosing the pointing of the earth station and NGSO satellite antennas" i.e. orbit avoidance.

This Intelsat analysis illustrates the complexity of accurately modeling the sharing problem between NGSO and GSO networks particularly in frequency bands where large link margins are required. It appears that the LEO EIRPs were assumed to be constant and set at the values published for the fully faded case at near maximum range to the LEO earth station. LEO A uses range compensation and automatic power control to compensate for rain attenuation. A 3 dB running margin is maintained at all times if possible for transient interference protection.

With the LEO A power control strategy as described above, a more realistic simulation would have used the clear air down link power from LEO A consistent with the elevation angle of the GSO earth terminal. The probability that LEO A would be powered up to overcome a rain event while crossing an in line interference geometry, is extremely low. Also, on the up link, if LEO A powers up to overcome a rain cell, that cell probably blocks the increased power to the GSO as well. The more realistic simulation is to assume LEO A interference powers are the clear air levels adjusted for range to maintain a 3 dB running margin.

The geographic placement of the earth stations was at a latitude of 60° north so that the elevation angle to the earth stations was 10° to the GEO arc. It is not possible to deduce the effect at lower elevation angles from this analysis. Additionally, "no satellite antenna discrimination patterns were used". Probably, that means they only used 3 dB beam widths which however, does not induce a big error for these narrow beam antennas.

With the assumptions used in this analysis sharing between Low Earth Orbiting NGSO networks and GSO appears to be <u>not feasible</u> without "orbit avoidance" by the NGSO earth stations. It is difficult to determine whether the conclusion would change if the more realistic assumptions on power control were used at lower latitudes.

<u>United Kingdom (TG4-5/86)</u> also performed simulations of interference between NGSO and GSO networks at Ka-Band. Earth stations located at different latitudes were considered and for LEO A, the interference at both minimum EIRP and maximum were considered. As with the Intelsat paper, the same short term interference criteria was used for digital links and GSO link margins. It was concluded that there is acceptable levels of interference into the GSO network on the up link but not on the down link. In all cases the GSO network employed earth terminals with beam widths about **0.1°, site diversity** and the link margins as proposed by Intelsat.

If a single satellite of the 66 constellation LEO A is considered, the short term interference requirements of the GSO can be met. But the impact of all 66, which in fact would be operating to a single earth station in sequential time, it becomes excessive on the down link into a GSO earth terminal. This contribution concludes "The results when extrapolated for interference <u>from a</u> constellation of Non-GSO satellites show that in the majority of the cases the small time percentages of allowable interference to digital carriers <u>will not be met</u>." Also, the criteria for C/I for TV service was also unacceptable.

<u>Table 9 Section 3.1.3</u> summarizes the results of these sharing studies and seems to be largely based on the UK paper TG4-5/86. The entries on interference into GSO for 20/30 GHz band generally tend to support the conclusions of the previous two studies just cited. No problem from up link if from a LEO with characteristics like LEO A but excessive short term interference into the down link from a LEO.

<u>VSAT GSO Earth Terminals</u>

<u>US CPM95/15A (DRAFT)</u> is a detailed contribution by Hughes which considers the case of LEO A NGSO sharing with a GSO linked with a number of VSATS at KaBand with both 1 and 3 degree beam widths. Simulations were run with co-located earth terminals at US CONUS latitudes. Clear air power levels were assumed for both up and down links although the LEO A EIRPs for the down link in Table 3 is 3.2 dB less than noted for the clear air case.

A series of interference events and levels were run of the 66 constellation against a single GSO satellite and an associated earth terminal. The cumulative probability distribution is plotted of the I/N into the GSO network receivers.

It is unclear what budget allocation should made for short term interference into the Hughes GSO receivers as the link margins are not consistent with the model proposed earlier by Intelsat for transparent transponders and GSO earth terminal site diversity is not employed. This GSO is a processing satellite with asymmetrical links. From IWG-4/59 it appears that to meet the service objectives for this GSO ,the minimum Eb/No for the up link is 8 dB and 5 dB on the down link. The probability distribution plots indicate, as expected, that the down link into the GSO earth terminals is the dominant interference problem.

If failure to meet service objectives is an unacceptable level of interference, then an I/N of 4.0 dB would reduce the Hughes GSO nominal down link clear air Eb/No from 10.5 to 5.0 dB. Figures 1A and 1B indicate that this level of interference would occur for more than .01% of the year. Figure 2A and 2B shown that these levels can occur for times up to 5 seconds in length.

It is unclear on how to translate this data to a collection of co-frequency VSATs scattered among the GSO spot beams or to the case when the GEO arc if fully loaded every 2 or 3 degree with co-frequency GSO satellites.

CPM95/25 was a contribution to the CPM from Canada which considered mutual interference between ICOs LEO B (CDMA) and LEO F(TDMA) and Canada's Advanced Satcom which plans to use narrow band USATs earth terminals about 20 cm in diameter in the 29.5 - 30.0 GHz sub-band. Neither up link or down link interference was a problem with LEO B due to the spreading of the CDMA signal. LEO F had very short interference events on the down link and very short but intense interference events on the up link. It was concluded that all interference events into the GSO network would be acceptable to the GSO network.

Interference from GSO networks into NGSO networks

Large GSO Earth Terminals

United Kingdom (TG4-5/86) appears to be the most definitive input on this scenario. For the case of the MSS LEO A being the victim network, the up link interference is the most severe as the GSO must overcome the 30 dB increased range loss. Table 3(c) indicates that the short term interference criteria of 70%Nt would be exceeded for 0.11% of the year with up to 28 short term outages per day. It is unclear of what power programming strategy was attributed to LEO A for this analysis. In their earlier paper (TG 4-5/69), their statistics for the same scenario at the equator use clear air and full up link power from the LEO. This gave a 7.42% cumulative probability distribution for the clear air and .069% if LEO A powered up to overcome interference. This data was not repeated in TG4-5/86 so it is hard to deduce the true state of affairs. However, these availability statistics are all much poorer than that required by Iridium.

Table 9 CPM-95/6 Section 3.1.3 only shows the availability statistics for the 14.8Nt level at .008% with a mean time between events of 3 hours for this interference scenario. Motorola is unable to use this table to determine the statistics for a 79%Nt. However, in checking TG4-5/86, it appears that the cumulative probability of outage at 0.78Nt would exceed **0.1 %**. Far in excess of the allowable short term allowance for LEO A of .01%.

Since the GSO also has high gain earth terminal antennas, it appears that the down link pfds are comparable and the excess interference into the narrow beam NGSO s occurs for only short periods of time. Some form of preprogrammed power control on the part of the NGSO could mitigate interference levels in this scenario

VSAT GSO Earth Terminals

CPM95/25 proposed that LEO B could tolerate an up link C/I of no more than 0.3 dB for less than 0.12% of the time. Their simulation indicated that the up link C/I had 25 dB less than this limit and clearly mitigation techniques were required. Severe up link interference was also noted with LEO F.

US CPM95/15A (DRAFT)Figure 4A and 4B indicate that the cumulative probability distribution for an I/N greater than 79% into LEO up link would be exceeded for greater than 0.5% of the time and with events lasting up to 24 seconds as shown in Figure 11. This would seriously degrade the service objectives of LEO A.

Interference Reduction Mechanisms

Section 3.1.5 Part C of the CPM discusses in a qualitative manner a number of **principles** that could be employed to reduce interference levels and frequency of the in line events. These principles are examined below for the Iridium system with its moderate data rates, power programming strategy, and rigorous service quality requirements.

Adaptive Power Control

It is possible for LEO A to preprogram the up link and down link signal levels in anticipation of an excess in line event into its network. However, when operating to an earth terminal at low elevation angles the power control range is limited. If frequent power adjustments of the down link were required, then prime power consumption could be a problem i. e. numerous co-frequency terminals and a full GSO arc. The amount of power control required is reduced if large geographic isolation between earth terminals is practical.

Geographic Isolation

If the GSO employs spot beams that do not have 100% frequency reuse, then some interference reduction is possible with geographic separation. However, GSO spot beams at these frequencies are several hundred miles across and therefore the geographic separation might impose unreasonable constraints on either service. If multiple co-frequency GSOs are spaced along the arc it is difficult to see how this technique would be effective. The Canadian study of VSATs sharing with ICOs indicated geographic isolation of up to 1000 km might be required.

Use of High Gain Antennas

The studies certainly indicate that the frequency of the in line interference events is reduced if both systems use high gain earth station antennas (≈ 0. 1° beam width). Unfortunately, it is impractical to employ such large apertures on Non-GSO/MSS satellites. Clearly, numerous VSATs with low gain antennas cannot share as readily as GSO networks with a few high gain earth terminal antennas.

Path Diversity

- Satellite Diversity: It is suggested that it is "conceptually " possible to switch to an alternative Non-GSO satellite to avoid an in line event if inter satellite links are employed. The Iridium system employs inter satellite links but visibility statistics of the 66 satellite system at mid or lower latitudes preclude that possibility. Switching back and forth between gateway stations is also impossible without large periods of interrupted service as by necessity the satellite switches are not easily reprogrammed from the earth. Reestablishing connections to the local PSTN from another gateway thousands of miles away is not possible without further outages. Other proposed NGSO constellations are considering using satellite diversity for their service links and might permit this type of mitigation.
- Site Diversity: The Iridium system might employ site diversity to increase availability in some climatic zones. Site diversity spacing is restricted to about 50 km due to problems of differential delay at the moderate data rates combined with atmospheric statistics. This would do nothing to alleviate the major interference event of the GSO up link into the spacecraft antenna side lobes as seen in Figure 2.

NGSO/MSS Sharing with FS

It must be remembered, that an additional constraint on the NGSO/MSS and GSO networks is the requirement for sharing with FS on most sub-bands in the 20/30 GHz spectrum. Iridium avoided placing its feeder links in the sub-band 29.5-30.0 /19.7-20.2 as the band is allocated for MSS, has no FS and therefore no downlink pfd limits. Therefore, this band was most likely to be exploited by GSO VSAT systems. On the other hand, the rest of the sub bands have FS allocations on a co-primary basis. Motorolas initial assessment was, that coordination was possible with FS using the guidelines of Rec 749 and 747 as conventional FS uses narrow beam antennas and mode 2 propagation distances are short in the 20/30 GHz band. Motorola participated in the 1994 NRM relative to sharing with a Local Multipoint Distribution Systems, a FS network consisting of omni broadcasting antennas and concluded sharing was possible with certain constrains on both services. It notes that the NRM concluded that sharing was not possible with GSO VSAT systems. It is difficult to believe that an Iridium like system could successfully coordinate with FS and VSAT type GSO networks even if all were on a co-primary status.

Conclusions

Section 3.1.8 of CPM95/118 concludes that ,"**by use of interference reduction mechanisms, frequency sharing may be possible at 20/30 GHz in some cases**" It should be noted that this conclusion is based on simulations which used an interference criteria for NGSO/MSS networks which is an order magnitude too relaxed for a system like Iridium. However, it is generally true, that where practical interference reduction techniques can be employed such as geographic separation and adaptive power control, that interference into GSO networks may be kept to permissible limits if there is only a single GSO satellite within the field of view of the NGSO earth station and its earth terminal antenna is narrow beam. No simulations were performed with multiple GSO satellites within the field of view.

All studies show that the up link interference into a LEO or ICO is the dominant problem. Recent experience in coordinating between Iridium and GSOs in Italy and Japan bear this observation out. Both countries use large aperture earth terminals and spots on their spacecraft, but it is not possible to achieve geographic separation sufficient to protect the NGSO up link from unacceptable peak interference events. Of course, for both these cases studied, there is only one co-frequency GSO satellite in the field of view of the NGSO earth station.

3.1.8 goes on to conclude that, "**in parts of the 20/30 GHz bands allocated to both FSS and MSS(i.e. RR 873B) where small (approximately 0.2 m diameter antennas) and mobile earth stations are used by the GSO networks, sharing between such networks and non-GSO/MSS feeder links would place severe constraints on the GSO networks for protection of the Non-GSO/MSS networks**" These conclusions are the result of sharing studies between ICO MSS networks and VSAT GSOs. There is reason to conclude the situation would be worse with a LEO due to the increased range differential on the up link.

Proposed Recommendations for US Position at WARC 95

To date, there has been negligible utilization of the 17.7-20.2 GHz and 27.5-30.0 GHz bands for GSO FSS with 5.0 GHz of combined up and down link bandwidth available every few degrees of the arc. The studies conducted to date, show there is no possibility of co-frequency sharing between NGSO/MSS feederlinks as planned by Iridium and VSAT GSO/FSS networks. Sharing may be possible with large aperture GSO terminals if there are only a few co-frequency GSOs in the visible arc.

It is therefore recommended that the US in general support the second option in Chapter 4 Section 4.2.4.2 Bands above 17.7 GHz in final CPM report. This option "**identifies certain sub-bands in the 17.7-19.7 GHz and 27.5-29.5 GHz bands be used primarily by non-GSO/MSS as it guarantees future access to all FSS applications. This second option would entail the following:**

- RR 2613 (S22.2) would be waived in those sub-bands identified for use primarily by non-GSO/MSS feederlink networks
- accommodations of existing GSO/FSS networks would be provided such that they would continue to have equal status with respect to non-GSO/MSS feederlink networks in those specific sub-bands
- within these specific sub-bands, future GSO/FSS networks would not cause harmful interference to, or receive protection from, non-GSO/MSS feederlink networks.

Specifically it is recommended that footnotes encompassing this option be part of the U.S. proposal to WRC-95. These footnotes should be associated with the sub-bands 19.2-19.7 GHz (space-to-Earth) and 29.0-29.5 GHz (Earth-to-space).

The reasons for this recommendation of 500 MHz in each direction are several. First, actual coordination experience indicates that spectrum will be lost in the coordination process. Second, it is likely that the allocation will need to be shared by one or more systems; on a co-directional, co-polarized basis. This would not be possible if during the interim more GSO systems would intend to use the band.